ABSTRACT OF THE DISCLOSURE

The invention relates to a solid oxide fuel cell which comprises a solid electrolyte comprised of an electronic insulator which allows transfer of anions, a ceramic-metal composite anode and a cathode. The fuel cell also comprises a sulfur-containing hydrocarbon fuel having a sulfur content of from about 1 ppm to about 5000 ppm and an oxygen source. The invention further relates to a process of producing electrical energy with the fuel cell and a process of restoring the operability of a fuel cell that was deactivated by sulfur poisoning.

The invention also relates to a method for preparation of a porous cermet as a direct-oxidation anode with supported electrolyte structure for a solid-oxide fuel cell using a nickel cermet. The nickel cermet is leached to remove at least part of the nickel, thereby producing a porous oxide. The resulting porous oxide is then impregnated, preferably with a salt of copper, which is calcined to CuO, then reduced to elemental copper. The resulting copper cermet or copper-nickel alloy cermet can be used as the direct-oxidation anode. The starting material for the nickel cermet is preferably a tape formed from a slurry comprising NiO and a ceramic powder comprising YSZ. This tape is combined into an assemblage with one or two additional tapes cast from a slurry comprising a ceramic powder. The invention further relates to a solid-oxide fuel cell comprising an anode material with supported electrolyte structure made by this method and a process for producing electrical energy using this fuel cell.

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